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Final Lesson I

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Activity Summary: Students will measure the distance Matchbox cars travel down ramps covered with different materials (a carpet strip, a felt strip, a smooth plastic strip, and a sandpaper strip.) Then they will create a class-wide spread sheet to compare the distances the cars traveled and discuss the impact of friction. The students will conduct an experiment that shows how friction and surface texture can increase or decrease motion.

Unit of Study: Forces and Motion

Grade Level: 2nd

Adapted from: <http://www.ideastream.org/common/images/education/exploring/force-motion-experiment.pdf>

Purpose: This lesson targets several Grade 2 Science Standards as described in the NYS Scope and Sequence regarding Forces and Motion. It is also in line with the Elementary Core Curriculum standard regarding The Physical Setting. In this activity, students will observe the influence that different surfaces have on the distance a Matchbox car travels. Students will come to understand that changes in motion are due to the effects of friction and that friction is a force that opposes motion. In addition, students will understand that friction is caused by changes in surface texture and amount of force pressing objects together.

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| **K-8 Science Scope and Sequence**  **Grade 2**  **Unit 2: Forces and Motion** | **Elementary Science Core Curriculum**  **Standard 4: The Physical Setting**  Key Idea 5: Energy and matter interact through forces that result in changes in motion. |
| PS 5.1a Observe and describe the position of an object relative to another object (over, under, on top of, next to). | 5.1a The position of an object can be described by locating it relative to another object or the background (e.g., on top of, next to, over, under, etc.). |
| PS 5.1b and PS 5.1c  Demonstrate how the position or direction of an object can be changed by pushing or pulling (forces and motion):   * Change the direction of objects by pushing and pulling using blocks, ramps, cars, and balls.   – Inclined plane | 5.1b The position or direction of motion of an object can be changed by pushing or pulling. |
|  | 5.1d The amount of change in the motion of an object is affected by friction. |

Professional Development Standards (Charlotte Danielson’s Framework for Teaching)

Competency 1e: Designing Coherent Instruction

* Learning activities
* Instructional materials and resources
* Lesson and unit structure

Competency 2a: Creating an Environment of Respect and Rapport

* Teacher interaction with students
* Student interaction

Competency 2c: Managing Classroom Procedures

* Management of instructional groups
* Management of transitions
* Management of materials and supplies

Competency 3a: Communicating Clearly and Accurately

* Directions and procedures
* Oral and written language

Competency 3c: Engaging Students in Learning

* Representation of content
* Activities and assignments
* Grouping of students
* Instructional materials and resources
* Structure and pacing

Objectives:

1. Students will conduct an experiment to show how friction works and what results from it.

2. Students will observe that different surface textures produce different amounts of friction.

3. Students will explain how friction and surface texture can increase or decrease motion.

Students will:

* Discuss findings with classmates
* Ask questions about findings of other groups
* Generate questions based on what they have observed and suggest further inquiry

Materials (for each group):

1. Matchbox Cars

2. Wooden planks

3. Carpet strip

4. Felt strip

5. Plastic strip

6. Sandpaper strip

7. Yardstick

8. Set of books (same height for each group)

9. Car Race experiment sheet

10. Access to spread sheet

Lesson Procedure

1. Pre Assessment: Students will respond to the question: “What will change how far a Matchbox car can travel?” on their Car Race experiment sheet.

2. Each group will be presented with a wooden plank and four different surfaces which the cars will travel down (covered with carpet, felt, plastic, and sandpaper.)

3. Each student will look carefully and feel the four different surfaces. On his/her Car Race experiment sheet, he/she will rank the surfaces from one to four. One being the surface on which he/she thinks the car will go the shortest distance, four being the surface on which he/she thinks the car will travel the furthest distance.

4. Each group will be given a book to raise the plank a few inches off the ground, one Matchbox car, and a yardstick. Let groups set up the ramp on the floor.

5. Have each group take the strip of carpet and place it on the plank. The "driver" should place the car at the top of the ramp with the back of the car lined up with the end of the ramp. The "driver" will then let go of the car (tell the students not to push the car.) The students will watch the car travel down the ramp and wait for it to come to a stop.

6. As a group they will measure the distance the car traveled, measuring from the bottom of the ramp to the front of the car. If the car stopped before reaching the bottom of the ramp, they will measure from the front of the car to the bottom of the ramp and put a minus sign (-) in front of the number.

7. Each student will record the distance traveled in Trial #1 on the observation sheet. Have the students repeat the test two more times and record the distances under Trial #2 and Trial #3.

8. Have the students replace the carpet surface with the felt strip and repeat the test.

Do this for each remaining surface (plastic and sandpaper).

9. When all surfaces have been tested and all distances recorded, come around and help groups calculate the average distance for each surface.

10. Students will then work with their group to summarize their results and try to develop an explanation for them.

11. Class will come back to the rug and record the data on a class-wide spreadsheet.

12. Groups will share what they believe caused their results and whether their predictions were correct or incorrect.

13. Question for discussion:

* Ask the students who has heard of friction? What does it do? How does it work?
* Then discuss their prior knowledge of the topic.
* Ask the students to lightly place their hands together and rub their hands back and forth. As they are in the act of rubbing their hands back and forth, ask them to press their hands together harder and then even harder. Then ask, “What did you noticed?”

14. Introduce concept of friction. Explain that the amount of friction depends on the surface material and the force pressing objects together. The sandpaper was rougher and slower than the plastic strip.

15. Ask the students for real life examples of friction and how we use it and then provide them with additional information

* There are many uses for friction.
* Why do we sand our streets in icy conditions?  
  (Streets are sanded to increase friction and help ensure safe driving.)
* Why does a skier or snowboarder use wax on his/her board?  
  (They use wax to decrease friction and increase their speed.)
* How do we slow down or come to complete stops in cars?  
  (The brake pads use friction by rubbing together on the rotor to get the car to slow down or stop.)

Post Assessment: Each student will use the spreadsheet the class created to explain the effect of friction on how far a Matchbox car rolls. Each student will write about this on his/her Car Race experiment sheet.

Students’ understanding will be evaluated when teacher is circulating during the experiment using a rubric, throughout the sharing of results, for the duration of the discussion about friction, and after collecting the Car Race experiment sheets.

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| Rubric for “Car Race” Activity | | | | |
|  | **4**  **(Above Standard)** | **3**  **(Meets Standard)** | **2**  **(Approaches Standard)** | **1**  **(Far Below Standard)** |
| **Independence** | Student was able to design and carry-out the activity independently. | Student was able to design and carry-out the activity with minimal teacher assistance. | Student was able to design and carry-out the experiment with moderate teacher assistance and prompting. | Student required a great deal of teacher assistance and prompting to carry-out the experiment. |
| **Attention and engagement** | Student remained engaged throughout the experiment and was able to assist classmate(s) in need of support. | Student was engaged throughout the experiment with no more than one verbal cue to remain on-task. | Student required 2-3 verbal reminders to remain engaged and on- task throughout the experiment. | Student required more than 4 verbal reminders to remain on-task throughout the experiment. |
| **Student understanding** | Student understands that different surface textures produce different amounts of friction. Student can explain how friction and surface texture can increase or decrease motion. | Student understands that different surface textures produce different amounts of friction and that friction and surface texture can increase or decrease motion. | Student has an incomplete understanding about how different surface textures produce different amounts of friction and that friction and surface texture can increase or decrease motion. | Student does not understand that different surface textures produce different amounts of friction and that friction and surface texture can increase or decrease motion. |